STEERING COLUMN ASSEMBLY HAVING BREAK-AWAY DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The subject invention relates to an energy absorbing steering column assembly for a vehicle, and more particularly to a mechanism of a shift lever assembly of the steering column that capable of reducing an impact on a driver and improving energy-absorption characteristics of the steering column assembly.

2. Description of the Prior Art

[0002] Contemporary automobiles are equipped with numerous safety features that include air bags and energy absorbing devices connected to a steering column assembly. Energy absorption devices include mechanisms that permit a controlled collapse of the steering column, wherein the air bags, mounted on a wheel of the steering column assembly, are designed to deploy in the event of a collision to provide protection to the driver. In addition to the airbag, adjustable position columns are typically fitted with energy absorbing device including an energy absorbing straps or the like, that allow the steering column to collapse during a collision at a controlled rate when impacted by the driver to offer additional protection to the driver.

[0003] Differences in the steering column assembly designs include a fixed column assembly, a tilt column assembly, and a telescoping column assembly. These columns include a housing to engage various components of the steering column assembly including and not limited to warning flasher control devices, turn signal switches, ignition key port, windshield and washer control levers, an anti-theft devices, and a shift lever.

[0004] The art is replete with various designs of steering column assembly. The United States Patent Nos. 3,750,492 to Holmes, 6,273,466 to Suzuki et al., 6,419,269 to Manwaring et al., the United States Patent Application Publication Nos. 2002/0073798 to Ryne et al., 2003/0085560 to Shibayama, and Japanese Patent Nos. 00177602 JP to Miki et al. and 02002322 JP to Miki et al.

[0005] The Japanese Patent No. 00177602 JP to Miki et al. teaches a steering column assembly including an operation mechanism part operated by a shift lever fixed to the steering column, wherein both the steering column and the operation mechanism part are covered with a column cover. The steering column includes a metal plate having an impact absorbing plastic part connected thereto and defining a gap therebetween. During the collision, a driver's knee collides with the plastic metal plate that plastically deforms and absorbs energy.

[0006] The Japanese Patent No. 02002322 JP to Miki et al. teaches a steering column assembly including a support member secured to a bracket and designed for supporting a rear end portion of a shift lever in a manner allowing the rear end portion to freely rotate about an axis thereof. The support member is integrally provided with a mounting flange mounted to the mounting surface of the bracket being approximately parallel to the axis of the rear end portion of the shift lever. The mounting flange includes a fragile portion corresponding to the tip of the rear end portion of the shift lever. In the event of a collision, the driver's knees makes a secondary contact with the shift lever in a head-on collision, thereby breaking the mounting flange to reduce the load on the knees. The aforementioned designs mitigate impact to a driver's knee by a secondary collision without narrowing front space of a driver's seat. Hence practicable, these designs do not improve enough the crashworthiness response and effectiveness of energy absorption system of the vehicle.

[0007] There is a constant need in area of a steering column assembly design to provide a gear shift assembly capable of reducing impact on a driver and improving energy-absorption characteristics of the steering column assembly by pivoting a lever of the gear shift assembly in the direction transverse to the direction of the steering column assembly during the collision of the vehicle thereby improving the crashworthiness response and effectiveness of energy absorption system of the vehicle and reducing the likelihood of injury of the driver during the collision of the vehicle.

BRIEF SUMMARY OF INVENTION

[0008] A steering column assembly includes a housing having a longitudinal axis, a support member supported by said housing for movement about a shift axis, and a shift lever operatively connected to the support member and extending radially from the shift axis for shifting movement in a limited space. The steering column assembly includes a break-away device interconnecting the shift lever and the support member for limiting movement of the shift lever upwardly toward a parallel relationship with the shift axis and for releasing the shift lever for the movement toward the parallel relationship in response to a crash condition.

[0009] An advantage of the present design is to provide a steering column assembly capable of reducing impact on a driver and improving energy-absorption characteristics of the steering column assembly.

[0010] Still another advantage of the present invention is to provide a mechanism of the shift lever assembly to allow a shift lever, which extends from the shift lever assembly in a cantilevered fashion, to break away during a collision into the direction transverse to the direction of a collapse of the steering column assembly, thereby improving the crashworthiness response and effectiveness of energy absorption system of the vehicle and reducing the likelihood of injury of the driver.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0012] Figure 1 is a perspective view of a steering column assembly having a break-away device;

[0013] Figure 2 is a front view of the steering column assembly having the break-away device;

[0014] Figure 3 is a top view of the steering column assembly having the break-away device;

[0015] Figure 4 is a cross sectional view of the translating bracket disposed in a tubular

portion of a support member and a shear bolt extending therethrough presenting a locking engagement therebetween;

[0016] Figure 5 is a partial cross sectional view of the steering column assembly; and

[0017] Figure 6 is another partial cross sectional view of the steering column assembly.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring to the Figures 1 through 6, wherein like numerals indicate like or corresponding parts throughout the several views, a steering column assembly of the present invention is generally shown at **10.**

[0019] The steering column assembly **10** includes a housing **12** having a longitudinal axis **A**, a support member **14** supported by the housing **12** for movement about a shift axis, and a shift lever **16** operatively connected to the support member **14** and extending radially from the shift axis for shifting movement in a limited space. The steering column assembly **10** includes a break-away device, generally indicated at **20,** interconnecting the shift lever **16** and the support member **14** for limiting movement of the shift lever **16** upwardly toward a parallel relationship with the shift axis and for releasing the shift lever **16** for the movement toward the parallel relationship in response to a crash condition.

[0020] While either a tilting steering column assembly design or telescoping steering column assembly design (not shown) may adapt the break-away device **20** of the present invention, both being well known to those skilled in the art, only the tilting steering column assembly design **10** shall be described further. The tilting steering column assembly **10** includes the housing **12,** i.e. the upper housing **12** having terminal ends **22, 24** and a lower housing **26** pivotally coupled to the upper housing **12** to permit the upper housing **12** to tilt with respect to the lower housing **26** about an axis **B**. The upper housing **12** includes a flange **28** integral with and extending from the upper housing **12** to a peripheral edge **30.** The lower housing **26** is pivotably coupled to one of the terminal ends **22** of the upper housing **12.** The steering column assembly **10** includes a boss **32** of a generally tubular configuration integral with and extending from the peripheral edge **30** in a cantilevered fashion. The boss **32** is spaced from the upper housing **12** and extends parallel to the longitudinal axis **A**.

[0021] The steering column assembly **10** includes a cam assembly, generally indicated at **34,** disposed between the boss **32** and the upper housing **12.** The cam assembly **34** includes a crank member, generally indicated at **36,** having a body **38** including two opposite arms **40, 42** integral with and extending therefrom in a cantilevered fashion to a distal ends **44, 46,** respectively, and an elongated slot **48** defined in the body **38.** The cam assembly **34** includes a fastener **50** extending through the crank member **36** to connect the crank member **36** to the housing **12.** One of the arms **42** includes a slug **52** for connecting with a wire (not shown). Those skilled in the art will appreciate that this wire, attached to the slug **52,** extends from one of the arms **42** and is operatively connected with a transmission mechanism (not shown), upon pivotable rotation of the crank member **36** causes the transmission in the vehicle to shift to the appropriate position. The steering column assembly **10** includes a gate member **54** defined within the housing **12.** The gate member **54** includes a plurality of cells.

[0022] The support member **14** includes a tubular portion **60** and a cylindrical portion **62.** The tubular portion **60** is disposed within the boss **32** of the upper housing **12.** The tubular portion **60** of the support member **14** has upper **64** and lower **66** sidewalls adjacent and parallel one the other and being interconnected by a bottom wall **68** of the tubular portion **60.** A shifter pin **70** of the support member **20** extends perpendicularly through the tubular portion **60** of the support member **14.** The shifter pin **70** has first **72** and second **74** ends, wherein the first end **72** is further defined by a circular plate **76** having an opening defined therein. The second end **74** includes a ball **80** to engage within the elongated slot **48** of the body **38** of the cam device. The support member **14** includes a screw **82** that extends through the opening of the circular plate **76** to the support member **14** to connect the shifter pin **70** thereto.

[0023] The steering column assembly **10** includes a translating bracket **90** disposed within the tubular portion **60** of the support member **14.** The translating bracket **90** has top **92** and bottom **94** sidewalls adjacent and parallel one the other and a bottom **96** interconnecting the top **92** and bottom **94** side walls. The translating bracket **90** is pivotably connected to the support member **14** by first **98** and second **100** pivoting pins and operatively supporting the shift lever **16.** The first pivoting pin **98** extends through

the upper **64** and top **92** sidewalls sandwiched one with the other. The second pivoting pin **100** extending through the lower **66** and bottom **94** sidewalls sandwiched one with the other. The first **98** and second **100** pivoting pins are aligned with respect to one the other.

[0024] The shift lever **16** operatively connected to the support member **20** of the steering column assembly **10** includes a generally cylindrical configuration and has terminal ends **102, 104**. The shift lever **16** includes a clevis member **106** attached to one of the terminal end **104** of the shift lever **16.** The shift lever **16** is disposed between the top **92** and bottom **94** side walls of the translating bracket **90** and is pivotably connected therebetween by a central pin **108**.

[0025] The break-away device **24** includes a shear container or bolt, generally indicated at **110**, having a shell **112**, which extends through the upper side wall **64** of the tubular portion **60** of the support member **14** and the top side wall **92** of the translating bracket **90** sandwiched one with the other. The shear bolt **110** is spaced from the first pivoting pin **98** to present a locking engagement therebetween, as best shown in Figure 6. The shear bolt **110** includes a pyrotechnic fuse or charge **114** disposed within the shell **112**. The shear bolt **110** bolt is connected to a sensor device (not shown) by an electrical lead or electric wire (not shown). The sensor device includes an electrical circuit (not shown) with a power source and a switch. The switch is part of the sensor device. The sensor device senses the vehicle condition in a case of the crash to indicate the occurrence of the crash. When the steering column moves into the dash board during the crash, the switch is closed thereby directing the electric current through the electric lead or wire through the shear bolt **110** to ignite the pyrotechnic charge **114**. When the pyrotechnic charge **114** is ignited, it produces combustion products including heat. The heat ruptures or severs the shell **112** of the shear bolt **110** engaged within the support member **14** and the translating bracket **90.** The shear bolt **110**, being sheared off in the translating bracket **90** and the support member **14,** releases the translating bracket **90** from the support member **14.** When the shift lever **16** meets the dash board during the collision of the vehicle, the translating bracket **90** engaging the shift lever **16,** pivoting from the locking engagement with the support member **20** and releases the shift lever **16** for parallel relationship in response to the crash condition.

[0026] Those skilled in the art will appreciate that other designs of the break-away device **24** having the shear bolt **110**, as disclosed in the present invention, may be used for releasably holding the shift lever **16** against pivotal movement to the broken chain line collapse position during normal operation of the vehicle, which would operate in the crash event to release the shift lever **16** for pivoting movement about the pivoting pins **98, 100**. For example, the other designs of the alternative embodiment of the break-away device **24** include a pin without an explosive charge, a plastic shearable capsule. Still another alternative embodiment of the break-away device include a solenoid-activated retaining pin, which would normally hold the shift lever **16** against pivoting about the pivoting pins **98, 100**. During the crash, the solenoid-activated retaining pin releases the shift lever **22** toward pivoting.

[0027] The present design of the invention subject reduces impact on the driver and improves energy-absorption characteristics of the steering column assembly **10.** As appreciated by those skilled in the art, the upper housing **12** of the tilting steering column assembly **10** or a bracket of a telescoping steering column assembly, as shown in the aforementioned U.S. Patent No. 6,419,269 to Manwaring et al., includes breakaway capsules (not shown) engaged within each of the side walls. These breakaway capsules remain attached to a vehicle body frame (not shown). The predetermined force may occur during the collision. After separation of sidewalls of the bracket from the breakaway capsules, energy absorption straps disposed in and connected to the breakaway capsules control forward movement of an upper jacket of the telescoping steering column assembly. An anchor end of each strap is clamped to the sidewalls of the bracket by a strap fastener. The free end of each of the energy absorption straps passes through an energy absorption strap retainer. The strap retainers are secured to the breakaway capsules, respectively. As the straps pass through the strap retainers, the strap are bent into an arc and then restraightened to absorb energy. The design of the present invention presents the translating bracket **90** engaging the shift lever **16,** wherein the translating bracket **90** releases the shift lever **16** for parallel relationship in response to the crash condition, improves the crashworthiness response and effectiveness of the energy absorption system of the vehicle, and reduces the likelihood of injury to the driver.

[0028] While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.